

ISOPOOH interacting with plant surfaces – a new source of MVK?

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Isoprene is the most dominant BVOC emitted into the atmosphere. In rural areas with low concentrations of NO_x Isoprene can rapidly react with hydroxyl radicals forming several isoprene hydroxy hydroperoxide (ISOPOOH) isomers. It is known that ISOPOOH undergoes catalytical conversion on metal surfaces forming MVK and MACR and other oxygenated species. Thus, standard PTR-MS instruments containing metal drift rings convert ISOPOOH to MVK and MACR and cannot measure ISOPOOH artifact free.

In our studies we were interested in the surfaces catalyzed reactions of ISOPOOH on plant surfaces. For this aim we used poplar plants, which represent a major biomass producing species. For the experiments the poplars were placed in an enclosure setup with only PTFE, PFA and PEEK as ISOPOOH showed negligible decomposition on those materials. ISOPOOH was mixed quantitatively to the air stream with a Liquid Calibration Unit resulting in volume mixing ratios of 8-50 ppbv. A novel Switchable-Reagent-Ion-Time-of-Flight-MS (SRI-ToF-MS) instrument containing conductive peek drift rings was used to analyze the VOC composition switching between enclosure inlet and outlet in real-time. The use of H_3O^+ and NH_4^+ as reagent ions allows the fragmentation free measurement of isoprene peroxides and C_5 -diols. We investigated day/night (stomatal open-closed) changes and found under daytime conditions a strong uptake of ISOPOOH and a clear emission of MVK for low and high concentrations of ISOPOOH. Fumigation with 8-10 ppbv ISOPOOH under night conditions the poplar showed only a small uptake of ISOPOOH accompanied by no visible MVK emissions. But fumigation of poplar with 50 ppbv showed a clear uptake during night time conditions. This indicates that the plant surfaces also play an important role in producing MVK while undergoing surface assisted reactions with ISOPOOH. Moreover during long fumigation (6-8 h) with ISOPOOH the majority of investigated poplars showed increasing levels of stress indicating compounds like methyl salicylate.